REMARKS

Claims 1-34 and 36 are pending. By this Amendment, Claims 1-4, 8-15, 19 and 36 are amended. Reconsideration of the January 6, 2003 Official Action is respectfully requested.

Claim 5 was rejected under 35 U.S.C. § 112, second paragraph. The reasons for the rejection are stated at numbered paragraph 2 of the Official Action.

The Official Action asserts that "Claim 5 recites the limitation 'the particle counter' in line 6". However, Claim 5 was amended by the Amendment filed on December 18, 2001 to change "the particle counter" to "a particle counter". Accordingly, the rejection should be withdrawn.

Claims 15-28, 30, 33 and 34 were rejected under 35 U.S.C. §102(a) over WO 99/50886 ("Schoepp"). The reasons for the rejection are stated at numbered paragraph 4 of the Official Action. The rejection is respectfully traversed for the following reasons.

Claim 15, as amended, recites "a method of plasma conditioning a machined and/or sintered surface of a ceramic part of a semiconductor processing chamber, the part being made of a ceramic material, the method comprising treating the surface to reduce particles of the ceramic material attached to the surface by contacting the surface with a high intensity plasma before processing production wafers in the processing chamber with the ceramic part being present in the processing chamber" (emphasis added). Schoepp fails to suggest the combination of features recited in Claim 15 for the following reasons.

Applicant determined that if ceramic parts having a machined and/or sintered surface, which has not been subjected to the high intensity plasma conditioning treatment

recited in Claim 15, are present in a processing chamber while production wafers are being processed in the chamber, significant numbers of particles on the machined and/or sintered surface can contaminate the production wafers (page 10, lines 14-21 of the specification).

According to the method recited in Claim 15, the machined and/or sintered surface of the part is subjected to the high intensity plasma conditioning treatment before production wafers are processed in the processing chamber with the as-treated part present in the processing chamber. That is, production wafers are not present in the processing chamber when the part is subjected to the high intensity plasma conditioning treatment. Consequently, attached particles are removed from the surface of the part by the treatment and thus are eliminated as a source of particle contamination during subsequent processing of the production wafers in the plasma reactor in which the treated ceramic part is present.

The Official Action asserts that Schoepp discloses "treating a SiC surface and reducing particle contamination by supplying process gas to the processing chamber . . . and energizing the process gas into a plasma that comprises high density plasma . . . ." However, Schoepp does not disclose treating a SiC surface and reducing particle contamination as asserted in the Official Action. Schoepp discloses using silicon carbide as a material for one or more reactor surfaces to reduce metal and/or particle contamination of plasma-processed substrates by reducing plasma potential on the silicon carbide member and/or by reduced sputtering of non-silicon carbide chamber interior surfaces (page 2, lines 11-26). That is, Schoepp discloses that particle and/or metal contamination from the silicon carbide member is reduced by using the silicon carbide material. Schoepp does not suggest removing particles of non-oxide ceramic materials from the silicon carbide member, but, in

fact, discloses reducing the removal of such particles from the silicon carbide member. Thus, Schoepp does not suggest treating a machined and/or sintered surface of the silicon carbide material by a high intensity plasma processing treatment before processing production wafers in the processing chamber with the ceramic part being present in the processing chamber to reduce particles on the surface. Accordingly, Claim 15 is patentable over Schoepp.

Claims 16-28, 30, 33 and 34 depend from Claim 15 and, accordingly, also are patentable over Schoepp for at least those reasons stated for Claim 15. Withdrawal of the rejection is respectfully requested.

Claim 36 was rejected under 35 U.S.C. §103(a) over Schoepp. The reasons for the rejection are stated at numbered paragraph 6 of the Official Action. The rejection is respectfully traversed for the following reasons.

Claim 36 depends from Claim 15. For the reasons stated above, Schoepp fails to disclose or suggest the combinations of features recited in Claim 15. Accordingly, the combination of features recited in Claim 36 also is patentable over Schoepp. Withdrawal of the rejection is therefore respectfully requested.

Claim 29 was rejected under 35 U.S.C. §103(a) over Schoepp in view of U.S. Patent No. 6,267,121 to Huang et al. ("Huang"). The reasons for the rejection are stated in numbered paragraph 7 of the Official Action. This rejection is respectfully traversed.

Claim 29 depends from Claim 15. The Official Action acknowledges that Schoepp fails to disclose the combination of features recited in Claim 29. However, the Official

Action asserts that Huang cures the deficiencies of Schoepp. Applicant respectfully disagrees with these assertions for the following reasons.

Huang discloses a method of seasoning a plasma etcher that has been cleaned. During the seasoning, etch product is redeposited on the walls of the chamber to return the electrical characteristics of the chamber (col. 3, lines 32-37). However, Huang does not suggest installing a ceramic part having a machined and/or sintered surface (with particles of the ceramic part attached thereto) in the chamber, and treating the machined and/or sintered surface with a high density plasma to reduce the particles while seasoning the reactor. Accordingly, Huang fails to suggest modifying Schoepp to achieve the combination of features recited in Claim 29.

Thus, Claim 29 also is patentable over Schoepp and Huang. Withdrawal of the rejection is therefore respectfully requested.

Claims 1-14 were rejected under 35 U.S.C. §103(a) over U.S. Patent No. 5,904,778 to Lu in view of U.S. Patent No. 5,863,376 to Wicker et al. ("Wicker"). The reasons for the rejection are stated in numbered paragraph 8 of the Official Action. The rejection is respectfully traversed.

Claim 1 has been amended to recite the features of now canceled Claim 35. Accordingly, as Claim 35 was not rejected under this ground of rejection, Claim 1 is patentable over Lu and Wicker. Dependent Claims 2-13 are also patentable over Lu and Wicker for at least the same reasons as those stated for Claim 1.

Claim 14, as amended, recites a method of processing semiconductor substrates and reducing particle contamination during processing of the substrates, which comprises "(a)

placing at least one production wafer on a substrate holder in an interior space of a vacuum processing chamber, the processing chamber comprising a plasma reactor and including at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface exposed to the interior space, the exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment (i) after the part having been installed in the processing chamber and (ii) before processing production wafers in the processing chamber with the part installed in the processing chamber, the conditioning treatment comprising treating the exposed surface with a high density plasma while seasoning the processing chamber; (b) processing the at least one production wafer by supplying process gas to the processing chamber; and (c) removing the at least one production wafer from the processing chamber" (emphasis added). Claim 14 is also patentable over Lu and Schoepp for the following reasons.

It is acknowledged in the Official Action that Lu fails to suggest a non-oxide ceramic part with an "exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma condition treatment". However, the Official Action asserts that Wicker teaches exposing "the surface of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma treatment" and "Wicker's processing method would inherently result in the exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma condition treatment". Applicant respectfully disagrees with these assertions.

Lu discloses the formation of SiC films 42 on sintered or hot-pressed SiC 40 that may be shaped (col. 5, lines 38-44 and Fig. 2). Lu discloses that such sintered SiC sintered structures can produce particulate (col. 4, lines 5-9). Lu forms the SiC films by CVD, or another film deposition process, to provide a surface that is resistant to particulate formation. However, because the SiC film would cover particulate on the surface of the sintered or hot-pressed SiC 40, the substrate structure does not include a "surface exposed to the interior space" of a vacuum processing chamber, as recited in Claim 1. Rather, the SiC film, which covers the substrate structure, has a surface that would be exposed to the interior of the reactor chamber. Accordingly, Lu's coated structure is clearly different from a machined and/or sintered surface having particles of the material of the ceramic part on the surface. Thus, Lu does not suggest treating such machined and/or sintered surface by a high intensity plasma treatment, as recited in Claim 14.

The Official Action asserts that Schoepp discloses "treating a SiC surface and reducing particle contamination by supplying process gas to the processing chamber . . . and energizing the process gas into a plasma that comprises high density plasma . . . ." However, Schoepp does not disclose treating an exposed machined and/or sintered surface of a ceramic part made of a non-oxide ceramic material and disposed in a vacuum processing chamber to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment before processing at least one production wafer in the processing chamber with the treated ceramic part installed in the processing chamber. That is, in the recited method, when production wafers are processed in the processing chamber, a reduced number of particles are present on the

exposed surface of the part. Thus, Schoepp provides no motivation to modify Lu to achieve the combination of features recited in Claim 14, which is thus patentable over Lu and Schoepp.

Withdrawal of the rejection of Claims 1-14 is therefore respectfully requested.

Claims 31, 32 and 35 were rejected under 35 U.S.C. §103(a) over Lu in view of Wicker and further in view of Schoepp. The reasons for the rejection are stated in numbered paragraph 9 of the Official Action. The rejection is respectfully traversed for the following reasons.

Claims 31 and 32 depend from Claim 1. Claim 1, as amended, recites a method of processing semiconductor substrates and reducing particle contamination during processing of the substrates, which comprises steps of "(a) installing at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface in an interior space of a vacuum processing chamber so that the surface is exposed to the interior space; (b) after step (a), treating the exposed surface to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment; (c) after step (b), processing at least one production wafer by supplying process gas to the processing chamber; and (d) removing the at least one production wafer from the processing chamber" (emphasis added). That is, according the method recited in Claim 1, the at least one production wafer is processed in the processing chamber after the exposed surface of the ceramic part has been treated to reduce attached particles of the non-oxide ceramic material from the surface by a high intensity plasma conditioning treatment.

As explained above, the combination of features recited in Claim 1 is patentable over Lu and Wicker. For reasons stated above, Schoepp fails to cure the deficiencies of Lu and Wicker with respect to the method recited in Claim 1. Thus, the combinations of features recited in dependent Claims 31 and 32 are also patentable. Therefore, withdrawal of the rejection is respectfully requested.

For the foregoing reasons, withdrawal of the rejections and prompt allowance of the application are respectfully requested.

Respectfully submitted,

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Mark-up of Claims

1. (Twice Amended) A method of processing semiconductor substrates and reducing particle contamination during processing of the substrates, the method comprising steps of:

(a) installing at least one [substrate on a substrate holder] ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface in an interior space of a vacuum processing chamber so that the surface is exposed to the interior space[, the processing chamber including at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface exposed to the interior space, the exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment];

(b) after step (a), treating the exposed surface to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment;

[(b)] (c) after step (b), processing [the] at least one [substrate] production wafer by supplying process gas to the processing chamber; and

[(c)] (d) removing the at least one [substrate] production wafer from the processing chamber.

2. (Amended) The method according to Claim 1, wherein the processing chamber includes a substantially planar antenna which energizes the process gas into a plasma state

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by supplying RF power to the antenna and the process gas comprising at least one fluorocarbon gas[es], the [method] conditioning treatment further including conditioning the exposed surface by energizing the fluorocarbon gas into a plasma state and contacting the exposed surface with the plasma.

3. (Amended) The method according to Claim 2, wherein the plasma comprises a high density plasma and the [substrates] production wafers are processed by etching an oxide layer on the substrates with the high density plasma while supplying an RF bias to the substrates.

4. (Amended) The method according to Claim 1, wherein the ceramic part comprises a gas distribution plate supplying the process gas to the processing chamber and the processing chamber includes a substantially planar coil which energizes the process gas into a plasma state by supplying RF power to the antenna, the [method] conditioning treatment further including conditioning the exposed surface by adjusting pressure in the processing chamber to 200 to 500 mTorr, supplying the coil with 2000 to 2500 W of radio frequency power, and/or changing coil termination capacitance of the coil so as to move an area of higher intensity plasma across the gas distribution plate.

8. (Amended) The method according to Claim 1, [further comprising sequential steps of installing the ceramic part in the processing chamber,] wherein the conditioning

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treatment comprises conditioning the ceramic part by processing a single batch of non-production wafers in the processing chamber[, and processing production wafers in the processing chamber].

9. (Amended) The method according to Claim 1, wherein the processing chamber comprises a plasma reactor, the [method further comprising a step of conditioning the ceramic part after installation thereof in the processing chamber, the conditioning [step] treatment comprising treating the exposed surface of the ceramic part with a high density plasma while powering the ceramic part to increase ion bombardment thereof.

10. (Amended) The method according to Claim 1, wherein the processing chamber comprises a plasma reactor, the [method further comprising a step of conditioning the ceramic part after installation thereof in the processing chamber, the] conditioning [step] treatment comprising treating the exposed surface of the ceramic part with a high density plasma generated by energizing a halogen gas into a plasma state.

11. (Amended) The method according to Claim 1, wherein the processing chamber comprises a plasma reactor, the [method further comprising a step of conditioning the ceramic part after installation thereof in the processing chamber, the] conditioning [step] treatment comprising treating the exposed surface of the ceramic part with a high density plasma generated by energizing an inert gas into a plasma state.

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12. (Amended) The method according to Claim 1, wherein the processing chamber comprises a plasma reactor, the [method further comprising a step of conditioning the ceramic part after installation thereof in the processing chamber, the] conditioning [step] treatment comprising treating the exposed surface of the ceramic part with a high density plasma generated by energizing oxygen gas into a plasma state.

13. (Amended) The method according to Claim 1, wherein the processing chamber comprises a plasma reactor and the ceramic part is a silicon carbide part, the [method further comprising a step of conditioning the silicon carbide part after installation thereof in the processing chamber, the] conditioning [step] treatment comprising treating the exposed surface of the ceramic part with a high density plasma generated by energizing a fluorine containing gas into a plasma state.

14. (Twice Amended) A method of processing semiconductor substrates and reducing particle contamination during processing of the substrates, the method comprising:

(a) placing at least one [substrate] production wafer on a substrate holder in an interior space of a vacuum processing chamber, the processing chamber comprising a plasma reactor and including at least one ceramic part made of a non-oxide ceramic material and having a machined and/or sintered surface exposed to the interior space, the exposed surface having been treated to reduce particles of the non-oxide ceramic material attached to the exposed surface by a high intensity plasma conditioning treatment (i) after

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the part having been installed in the processing chamber and (ii) before processing production wafers in the processing chamber with the part installed in the processing chamber, the conditioning treatment comprising treating the exposed surface with a high density plasma while seasoning the processing chamber;

(b) processing the at least one [substrate] production wafer by supplying process gas to the processing chamber; and

(c) removing the at least one [substrate] production wafer from the processing chamber.

15. (Twice Amended) A method of plasma conditioning a machined and/or sintered surface of a ceramic part of a semiconductor processing chamber, the part being made of a ceramic material, the method comprising treating the surface to reduce particles of the ceramic material attached to the surface by contacting the surface with a high intensity plasma before processing production wafers in the processing chamber with the ceramic part being present in the processing chamber.

19. (Amended) The method according to Claim 18, wherein the processing chamber comprises a single wafer plasma reactor, the method further comprising plasma conditioning [being carried out] the exposed surface of the ceramic part while sequentially treating semiconductor substrates in the processing chamber.

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36. (Amended) The method according to Claim 15, further comprising:

a) installing the ceramic part in a plasma reactor;

b) after a) and before processing production wafers in the plasma reactor with the ceramic part installed in the plasma reactor, treating the surface of the ceramic part with the high intensity plasma in the plasma reactor; and

c) after b), processing production wafers in the plasma reactor.